



"Connect.
Sense. Analyze.
Predict."



WIRELESS BUSBAR TEMPERATURE MONITORING SYSTEM

FOR BUSBAR & SWITCHGEAR

BBC969-485RC

www.amptronics.com

BBC969-485RC

WBTMS Busbar Controller

Overview

Continues Busbar/ Bus Duct Temperature Monitoring System

Excessive temperature within a busbar / bus duct can be an early indication of electrical overloading, deteriorating connections, or increased contact resistance. If left undetected, prolonged overheating can degrade insulation and increase the risk of electrical faults, short circuits, equipment damage, and fire.

The **BBC969-485C** Receiver is a core component of the Wireless Busbar Temperature Monitoring System (WBTMS), designed to reliably capture and process RF signals from multiple wireless sensors. It supports seamless communication with **Busbar Temperature Sensors, Humidity Sensors, and Bus Duct Temperature Sensors** within a **10-meter operating range**, ensuring accurate and continuous monitoring of critical electrical assets.

The receiver collects essential parameters such as real-time temperature values and sensor battery status, enabling proactive maintenance and early fault detection. Its robust RF reception ensures stable data transfer even in electrically noisy environments.

Designed for **installation inside electrical control panels**, the BBC969-485C integrates effortlessly into existing systems. It is equipped with **two built-in relay outputs**, allowing independent alarm or control actions based on **temperature and humidity thresholds**. These relay outputs can be interfaced with external alarms, annunciators, or automation systems for enhanced safety and operational efficiency.

The BBC969-485C Receiver plays a vital role in delivering dependable monitoring, helping prevent overheating, reduce downtime, and improve overall system reliability in industrial and power distribution applications.



Features



24/7 hotspot detection



Din Rail Mounting



Wireless Communication
AES-128 encryption



RS485 / MODBUS



-45°C to 150°C



Support -60 BBC350BT
-28 RHT Sensors

Benefits

Organizations - Drive Safer, More Reliable Electrical Operations



- Gain continuous visibility into the condition of critical electrical assets and connections.
- Reduce CAPEX and OPEX by minimizing dependence on periodic thermographic inspections.
- Enhance workplace safety by reducing the need for personnel to interact with energized or potentially hazardous equipment.
- Identify emerging thermal issues early to prevent costly failures, unplanned downtime, and asset damage.
- Maximize asset performance, reliability, and lifecycle ROI through continuous condition monitoring.

Engineers - Enable Predictive Maintenance with Actionable Insights



- Extend asset service life through condition-based and predictive maintenance strategies.
- Eliminate the need for manual temperature checks at inaccessible or difficult-to-reach connection points.
- Transition from reactive maintenance to proactive asset management with continuous thermal intelligence.
- Monitor critical connection temperatures accurately and identify abnormal conditions before they escalate.
- Use real-time temperature data to support informed maintenance decisions and reduce the risk of unexpected failures.

Operations - Monitor Critical Connections in Real Time



- Continuously monitor the temperature of critical electrical connections and assets.
- Detect abnormal temperature rise and compromised joints before they develop into critical failures.
- Reduce the risk and cost of unplanned outages through early detection of developing faults.
- Receive real-time alarms and alerts when temperature conditions exceed defined thresholds.
- Improve operational reliability with continuous visibility into the health of critical electrical infrastructure.



Technical Data

General

Description	Value
Model Number	BBC969-485RC Controller
Max. sensors per Controller	Spread Spectrum Tech. with 60 BBS-350 & 28 RHT Sensors
Mounting	Din rail
Installation Location	Bus Ducts, Electrical Panels, Switchgear, MCC Panels, Control Panels
Enclosure	ABS Plastic
Operating Voltage	9-28 DC
Dry Contact Relay	2, Common - NO

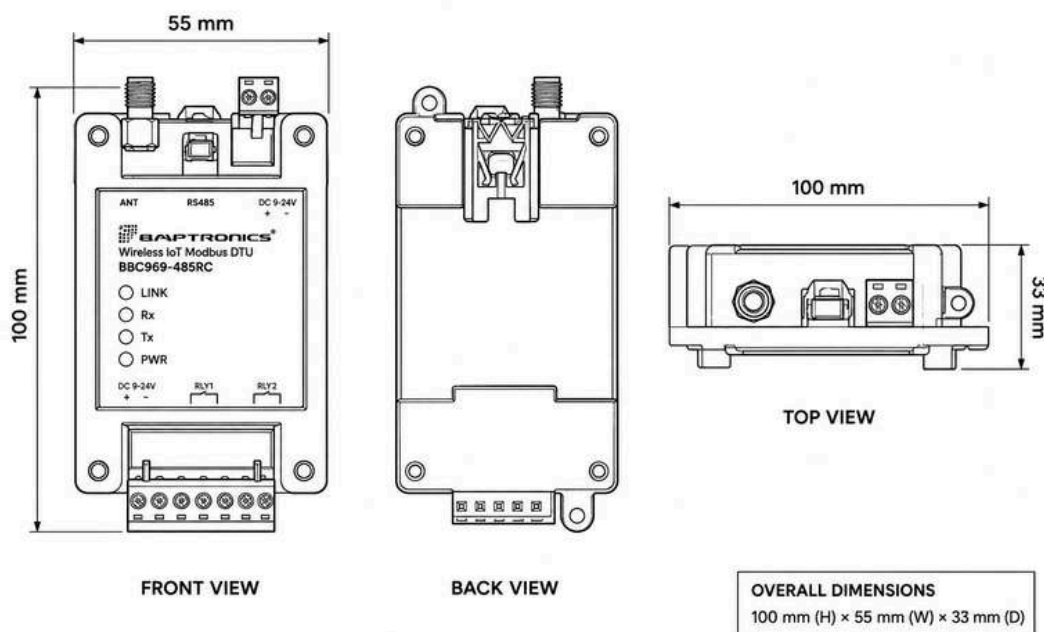
Communication

Description	Value
Wireless	Wireless Communication
Max Reception Range	10 Meter
Frequency	865-926MHz
Antenna	SMA Antenna with Magnetic Base -2mts
Communication Protocol	Modbus RTU over RS485 communication interface
Supported Sensors	BBC350-BT, BBC350-CT, AMP-WRHTC, AMP-WM2THC
Data encryption	AES-128 encryption

Mechanical

Description	Value
Dimensions (L×W×H)	100x 55 x 33mm
Weight	100gms

Dimensions



Sensor Node Setup with Controller

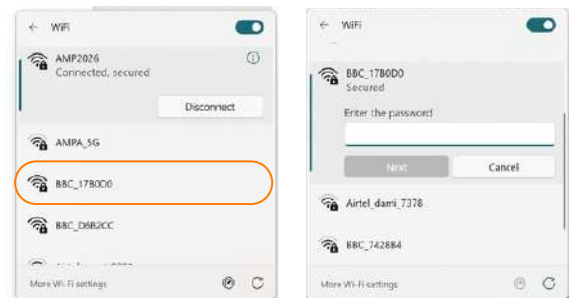
1.Enabling Wi-Fi on the Receiver

Power ON the receiver. To enable the device Wi-Fi, Single press the “reset” switch. Once Wi-Fi is successfully enabled, the Link **LED ON** indicator will appear on the controller, confirming active Wi-Fi status.



2.Connecting to the Receiver Wi-Fi

Once the device Wi-Fi is enabled, search for the receiver SSID on your computer's Wi-Fi network list. Select the SSID and connect to it. When prompted for the password (first-time connection), enter the default password BBC969-485RC to establish the connection.



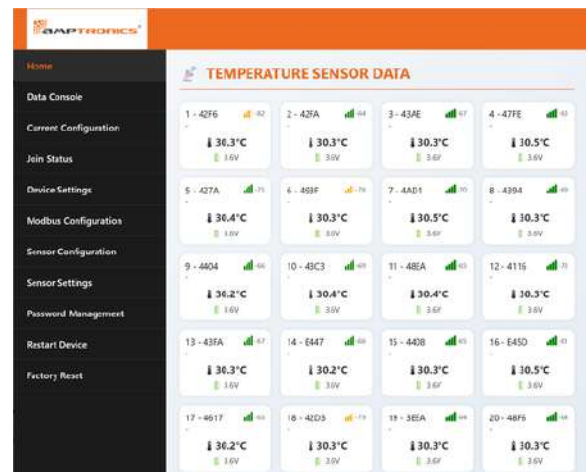
3.Accessing the Receiver Web Interface

Open a web browser on the connected computer and enter 192.168.4.1 in the address bar.

The login page will appear, prompting for a username and password. Enter the default credentials below to log in:

- Username: **admin**
- Password: **BBC969-485RC**

Once authenticated, the receiver configuration and monitoring interface will be accessible.

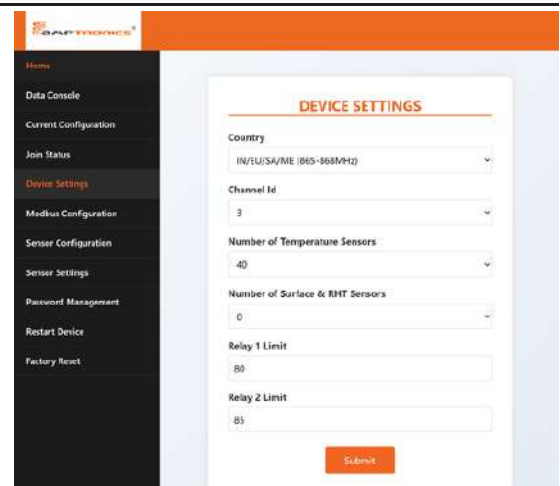


4.Device Configuration Settings

After logging in to the receiver web interface, navigate to the **Device Configuration** page.

On this page, select and configure the required parameters and submit, including **Country Frequency**, **Channel**, **Number of Busbar Sensors**, **Number of RHT Sensors**, **Operation Mode**, and **Relay 1 / Relay 2 limits**.

Detailed descriptions of each parameter along with their **default values** are provided in the table below. Configure the settings as per site requirements before saving the configuration.



SETTING	Value	Value
Country	BBBC969-485RC Supports multiple frequency bands across different regions. 0.IN/EU/SA/ME (865-868) 1.US/CA/AU/NA (920-923) 2.ID/VA/LA/HK (923-925)	IN/EU/SA/ME (865-868)
Channel	Supports up to 15 Channels	1
Number of Temperature Sensors	Supports up to 60 busbar Temperature Sensors	20
Number of Surface & RHT Sensors	Supports up to 28 Number of surface & RHT Sensors	0
Operation Mode		Modbus & WIFI
Relay 1 Limit	Relay 1 Temperature Set point	80
Relay 2 Limit	If no RHT sensors Relay 2 will act as Break Point or Act as Humidity Set Point	85

5. Sensor Configuration and Registration

Once the device settings are submitted, navigate to the **Sensor Configuration** page. Based on the configured number of Busbar Sensors and RHT Sensors, the corresponding sensor input entries will be displayed.

Locate the **Sensor UID** printed on each sensor label and enter the matching UID into the respective sensor configuration input fields. Ensure that each UID is entered accurately to avoid communication issues.

After completing the sensor configuration, submit the settings and **restart the receiver** to apply the changes and establish communication between the receiver and the configured sensor nodes.

Joining Sensors to the Receiver Network

1.Enable Receiver Join Permit

Once the receiver has restarted, enable the sensor join mode by double-pressing the Reset switch on the receiver.

When the join mode is successfully enabled, the Link **LED blinging starts**, confirming that the receiver is ready to accept sensor nodes into the network.

2.Enabling Wi-Fi & Connect Connecting to the Receiver Wi-Fi

Enable the receiver **Wi-Fi** and connect to the **Receiver Wi-Fi network**. Access the receiver web interface using a web browser.

Repeat the **Sensor Node Setup with Controller** procedures by following **Steps 1, 2, and 3** as described earlier to complete joining sensor to the receiver network.



3.Accessing the Data Console

After accessing the receiver web interface, navigate to the Data Console page. This section displays real-time data received from the configured sensor nodes, allowing users to monitor sensor status, temperature readings, and system activity.



4.Joining the Sensor to the Receiver Network

Switch ON the sensor. Once powered, the sensor automatically sends a join request to the receiver. The receiver validates the request and, upon successful authentication, accepts the sensor and adds it to the network.

Note:

Ensure the sensor is in **default factory mode** before attempting to join the network.

- When powered ON, **two LED blinks** indicate the sensor is in factory default state and ready to join the receiver network.
- If the sensor has already been paired with another receiver, it must be **factory reset** before joining a new network.
- To perform a factory reset, **press and hold the sensor switch for 5 seconds**. After reset, **five LED blinks** will appear, confirming the sensor is restored to factory default mode and ready for network joining.



The above image shows **1063 sensor nodes** successfully joined to the receiver network.

5.Completing Sensor Network Joining

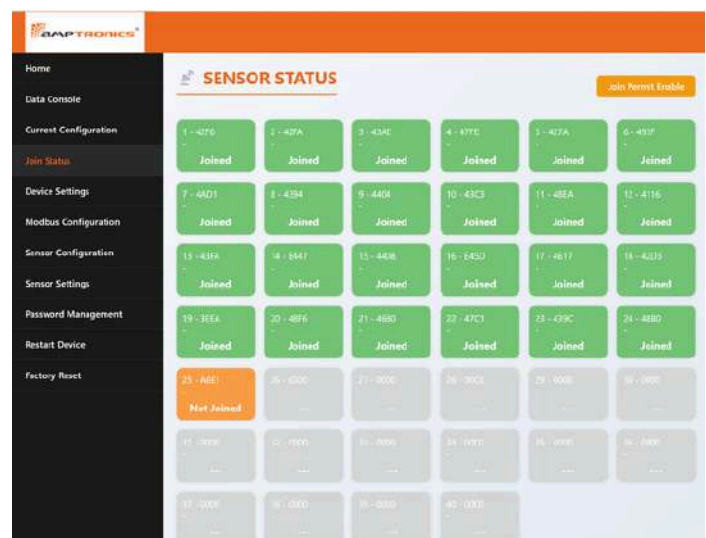
Repeat **Step 4** for all remaining sensors until each sensor is successfully joined to the receiver network.

6.Verifying Sensor Join Status

To verify the sensor join status, navigate to the **Join Status** page in the receiver web interface.

This page provides a visual confirmation of each sensor's network status:

- Green**: Sensor has successfully joined the network.
- Orange**: Sensor has not joined the network.
- Grey**: Sensor entry is not present in the configuration.



7. Completing the Sensor Joining Process

After all sensors have successfully joined the network, disable the receiver join mode by double-pressing the Up Arrow button.

The "J" join symbol will turn off on the receiver display, indicating that join mode is disabled. Once this is done, the sensors will begin regular communication with the receiver, ensuring continuous monitoring and network stability.

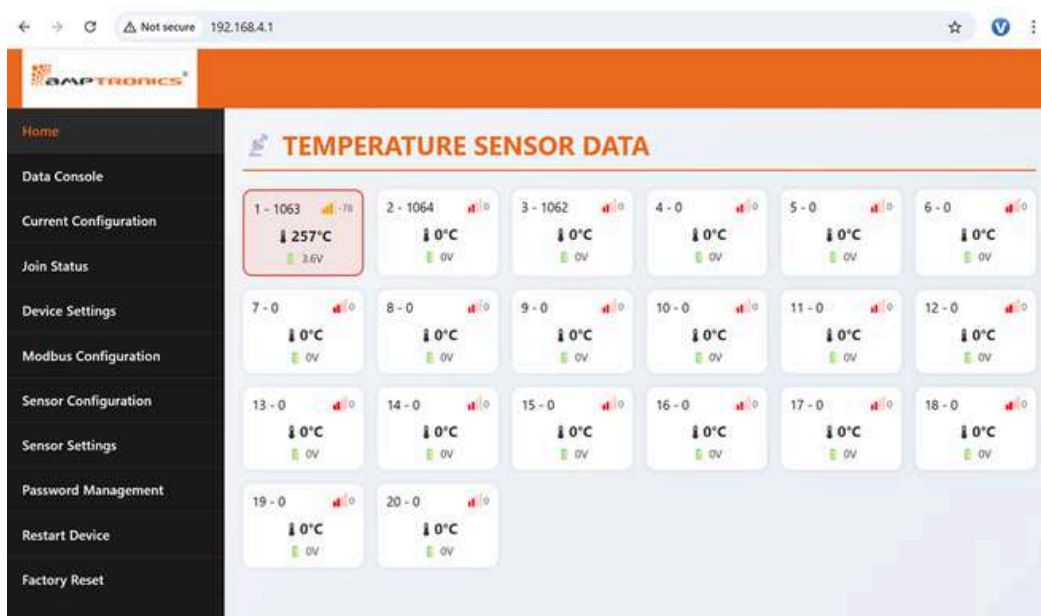
Verifying the Sensor Data

After all sensors have successfully joined the network and the receiver join mode is disabled, navigate to the Home page or check the receiver display. The sensor values will appear, including:

- Sensor readings (e.g., temperature, humidity)
- Battery voltage of each sensor
- RSSI (Received Signal Strength Indicator)

Note: To improve communication strength, adjust the sensor position or antenna so that all sensors show RSSI values in the green range, ensuring reliable data transmission.

RSSI Strength	Signal Strength	Signal Strength	Value
Above -75	Strong	Green	Excellent communication; no action needed
Between -75 to -95	Moderate	Orange	Signal is acceptable; consider repositioning sensor if possible
Below -95	Weak	Red	Risk of signal loss; adjust sensor position or antenna to improve signal

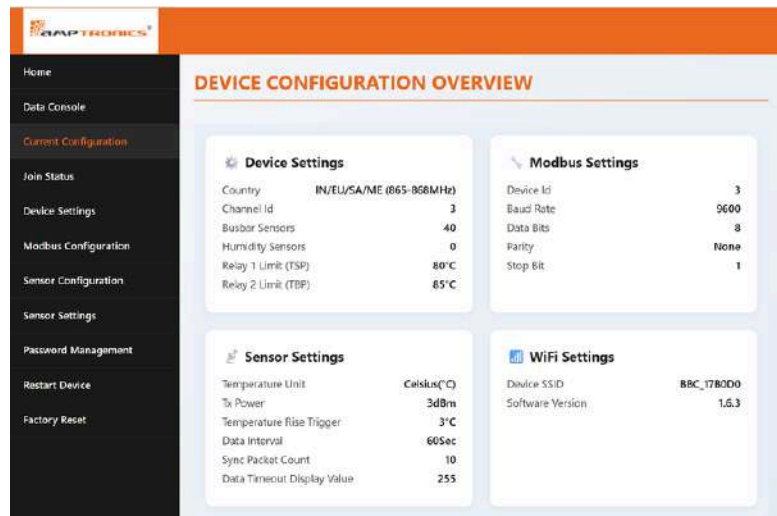


Note Sensor Error Values in Modbus

- If a sensor value displays as **255**, it indicates a **communication loss** between the receiver and the sensor.
- If a sensor value displays as **257**, it indicates that the **sensor is malfunctioning** and may require inspection or replacement.

Verifying Current Configuration Settings

To verify the current configuration settings of the receiver, navigate to the Current Configuration page in the web interface. Review the displayed parameters to ensure that all settings, such as Device Settings, Modbus Settings, Sensors Settings, and WiFi Settings match your intended configuration.

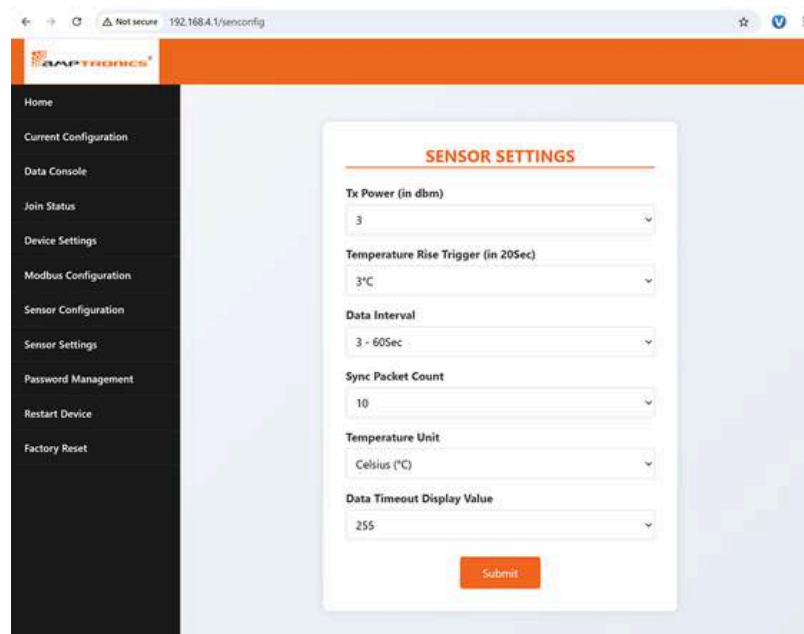


Modifying Sensor Settings

During the sensor joining process, the receiver automatically configures default values for each sensor. These sensor settings can be modified at any time through the web interface; however, the changes will take effect only after the sensor syncs with the receiver.

Sensor Settings Description

- **Tx Power:** The default sensor transmit (Tx) power is **3 dBm**. If a sensor is located far from the receiver and its **RSSI** falls below **-95 dBm**, the Tx power can be increased to improve connection reliability. Note: Higher Tx power increases current consumption and reduces battery life.
- **Data Interval:** Defines how often the sensor sends data packets to the receiver. The default interval is **60 seconds**.
- **Temperature Rise Trigger:** Sensors continuously compare the current temperature with the previous measurement every 20 seconds. If the temperature difference exceeds the **Temperature Rise Trigger** value, the sensor will immediately send an **event packet**, instead of waiting for the next 60-second interval. Event packets are indicated with an "E" on the Home page.
- **Sync Packet Count:** Specifies how often the sensor sends a sync packet to the receiver to receive updated configuration parameters. Once updated, the sensor resumes normal operation with the new settings.
- **Temperature Unit:** Allows temperature values to be displayed in either **°C (Celsius)** or **°F (Fahrenheit)**.
- **Data Timeout Display Value:** If communication between the sensor and receiver is lost, the default display value is **255**. This can be modified to **0** value as required.



Connecting to PLC or SCADA System via RS-485 (Modbus RTU)

This configuration enables integration of the receiver with a PLC or SCADA system using the RS-485 Modbus RTU protocol. The receiver supports multiple baud rates and configurable parity options (Even, Odd, or None), allowing compatibility with a wide range of industrial automation systems and standard Modbus configurations.

RS-485 Wiring Connection

Use the following pin connections to interface the receiver with the PLC or SCADA system:

- Receiver Pin 6 (A+) → Modbus A+
- Receiver Pin 7 (B-) → Modbus B-

Ensure proper termination and grounding practices are followed to maintain reliable communication and minimize noise in industrial environments.

Modbus Registers(0-Based Modbus Addressing):

1. Reading Device Setting Values:

The screenshot displays the AMPTRONICS web interface. On the left is a navigation menu with options like Home, Data Console, Current Configuration, Join Status, Device Settings, Modbus Configuration (highlighted), Sensor Configuration, Sensor Settings, Password Management, Restart Device, and Factory Reset. The main area shows the 'MODBUS SETTINGS' form with fields for Modbus Device Id (3), Baud Rate (9600), Data Bits (8), Parity (None), Stop Bit (1), and a Submit button. To the right is a 'Mdbpoll1' window showing a table of registers with columns Name, Value, and Default Value. The table lists registers from 0 to 18, including Device Id, Baud Rate, Databits, Parity, Stopbit, Country Id, Channel Id, No of BBS, No of RHT, Relay 1 Limit, Relay 2 Limit, Relay 1 Status, Relay 2 Status, Sensor Tx Power, Temp Rise Trigger, Data Interval, Sync Pkt Counter, Temp Display Unit, and Data Time Out Value. A 'Read/Write Definition' dialog is open, showing settings for Slave ID (1), Function (03 Read Holding Registers (4x)), Address mode (Dec), Address (0), Quantity (19), Scan Rate (1000 ms), and View options (Rows: 10, 20, 50, 100, Fit to Quantity). It also includes checkboxes for Hide Name Columns, Address in Cell, PLC Addresses (Base 1), and Enron/Daniel Mode. The Request section shows RTU and ASCII data representations.

Device Setting Request Example:

Device ID	Function Code	Starting Reg	Quantity
1	03	0	19

Modbus Register	Default Value	Options
Device id	1	<100
Baud Rate	1	0 - 4800, 1 - 9600, 2 - 19200 3 - 38400, 4 - 57600, 5 - 115200
Data bits	8	7 or 8
Parity	0	0-None, 1-Odd, 2-Even
Stop bit	1	1 or 2
Country Id	0	1 - IN/EU/SA/ME (865-868) 2 - US/CA/AU/NA (920-923) 3 - ID/VA/LA/HK (923-925)
Channel	1	1 to 15
No of Busbar Sensors	9	0 to 60
No of RHT Sensors	0	0 to 10
Relay1 Limit	800	Value = 800/10= 80
Relay2 Limit	850	Value = 850/10= 85
Relay 1 Status	0	If Alarm the Register Will become 1, For Acknowledge update with 0

Modbus Register	Default Value	Options
Relay 2 Status	0	If Alarm the Register Will become 1, For Acknowledge update with 0
Sensor Tx power	3	0 to 10
Temperature Rise Trigger	3	2 to 6
Data Interval	3	1 – 20sec, 2 – 40, 3 – 60sec, 4 – 80sec, 5 – 100, 6 – 120sec, 9 – 180sec, 12 – 240sec, 15 – 300sec
Sync Packet Counter	10	10, 20, 30, 40, 50, 60
Time Display Unit	10	0 - °C, 1 - °F
Data Time out Value	10	0 – 255, 1 - 0

2. Reading Busbar Sensor Values:

Each **Busbar Temperature Sensor** provides two parameters through Modbus registers: **Temperature** and **Battery Status**. All values received via **Modbus RTU** (for example, when using **Modbus Poll**) are **scaled by a factor of 10**.

To obtain the actual sensor value, **divide the received register value by 10**.

Example:

- Modbus value received: **325**
- Actual temperature value: **32.5 °C**

This scaling method ensures higher resolution and improved accuracy in sensor data representation.

Temperature values start from **register address 100** and **Battery values** start from **register address 300**. If the configured number of Busbar sensors is **20**, the register allocation is as follows:

- **Registers 100 to 119:** Temperature values for **Sensor 1 to Sensor 20**
- **Registers 300 to 319:** Battery values for **Sensor 1 to Sensor 20**

Each register corresponds sequentially to an individual sensor, ensuring a consistent and predictable mapping between sensor index and Modbus register address.

Parameter	Start Register	Ex: Reg for 20 sensors	Description
Temperature	100	100-119	Temperature values for Sensor 1 to Sensor 20
Temperature	300	300-319	Battery voltage values for Sensor 1 to Sensor 20

Sensor-to-Register Mapping Example

Sensor	Temperature Register	Battery Register
Sensor 1	100	300
Sensor 2	101	300
Sensor 3	102	300
----	----	---
Sensor 20	119	319

Temperature Request Example:

Device ID	Function Code	Starting Reg	Quantity
1	03	100	20

Battery Request Example:

Device ID	Function Code	Starting Reg	Quantity
1	03	300	20

Note:

Value	Description
2570	Sensor Error
2550	Data Time Out Value

3. Reading RHT & Busduct Sensor Values:

Each **Busbar Temperature Sensor** provides two parameters through Modbus registers: **Temperature** and **Battery Status**. All values received via **Modbus RTU** (for example, when using **Modbus Poll**) are **scaled by a factor of 10**.

To obtain the actual sensor value, **divide the received register value by 10**.

Example:

- Modbus value received: **325**
- Actual temperature value: **32.5 °C**

This scaling method ensures higher resolution and improved accuracy in sensor data representation.

RHT & Bus Duct Sensor Registers:

The register mapping for RHT and Bus Duct sensors starts from register address 500.

Parameter	Register
Ambient Temperature	500
Humidity	501
Surface/Duct Temperature	502
Battery	503

Each sensor occupies 4 consecutive registers

Sensor-to-Register Mapping Example (For 3 Sensors)

Sensor	Ambient Temp	Humidity	Surface/Duct Temp	Battery
Sensor 1	500	501	502	503
Sensor 1	504	505	506	507
Sensor 1	508	509	510	511

RHT Request Example:

Device Id	Function Code	Starting Reg	Quantity
1	03	500	12



Read/Write Definition dialog box configuration:

- Slave ID: 1
- Function: 03 Read Holding Registers (4x)
- Address mode: Dec (selected), Hex
- Address: 500, PLC address = 40501
- Quantity: 12
- Scan Rate: 1000 [ms]
- Disable: ☐ Read/Write Disabled, ☐ Disable on error
- View: Rows (10, 20, 50, 100, Fit to Quantity selected)
- Request: RTU 01 03 01 F4 00 0C 05 C1, ASCII 3A 30 31 30 33 30 31 46 34 30 30 43 46 42 0D 0A

4. Reading RSSI Values

The **RSSI (Received Signal Strength Indicator)** values represent the wireless signal strength between each sensor and the receiver. All values received via **Modbus RTU** (for example, when using **Modbus Poll**) are **scaled by a factor of 10**.

To obtain the actual sensor value, **divide the received register value by 10**.

Example:

- Modbus value received: **-650**
- Actual temperature value: **-65**

These values are useful for evaluating communication quality and ensuring reliable data transmission.

Busbar Sensor RSSI Request Example:

Device Id	Function Code	Starting Reg	Quantity
1	03	1000	20



Read/Write Definition dialog box configuration:

- Slave ID: 1
- Function: 03 Read Holding Registers (4x)
- Address mode: Dec (selected), Hex
- Address: 1000, PLC address = 41001
- Quantity: 20
- Scan Rate: 1000 [ms]
- Disable: ☐ Read/Write Disabled, ☐ Disable on error
- View: Rows (10, 20, 50, 100, Fit to Quantity selected)
- Request: RTU 01 03 03 E8 00 14 C5 B5, ASCII 3A 30 31 30 33 30 33 45 38 30 30 31 34 46 44 0D 0A

RHT Sensor RSSI Request Example:

Device Id	Function Code	Starting Reg	Quantity
1	03	1090	3

Read/Write Definition

Slave ID: 1

OK

Function: 03 Read Holding Registers (4x)

Cancel

Address mode

☒ Dec ☐ Hex

Address: 1090

PLC address = 41091

Quantity: 3

Apply

Scan Rate: 1000 [ms]

Read/Write Once

Disable

☐ Read/Write Disabled ☐ Disable on error

View

Rows

☐ 10 ☐ 20 ☐ 50 ☐ 100 ☒ Fit to Quantity

☐ Hide Name Columns ☐ PLC Addresses (Base 1)

☐ Address in Cell ☐ Enron/Daniel Mode

Request

RTU 01 03 04 42 00 03 A4 EF

ASCII 3A 30 31 30 33 30 34 32 30 30 33 42 33 0D 0A